Distr.
LIMITED

ID/WG. 418/1
24 February 1984

ENGLISH

United Nations Industrial Development Organization

Technical Congress held in conjunction
with the Third International Fair -
"Technology for the People"

Manila, Philippines, 23-25 November 1983

STRENGTHENING SOUTH-SOUTH BUSINESS TIES ON AGRICULTURAL MACHINERY AND RURAL ENERGY*

by

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V.84-82411

On behalf of the ESCAP Regional Centre for Technology Transfer (RCTT), may I express our appreciation for the invitation to address this important meeting. RCTT, a United Nations regional institution, was established in July 1977 to assist countries of Asia and the Pacific, through regional cooperation, in strengthening their national capabilities in technology development, transfer and information. RCTT has always endeavoured to bring its efforts in technology development, transfer and information as close as possible to actual trade and industry. Thus, it always welcomes every opportunity, such as this, to have a dialogue with the various entities in the public and private sectors who play a crucial role in syndicating technology ventures.

Strengthening South-South ties in trade and technology has always been a major preoccupation of third world countries as reflected in the many pronouncements and agreements made in various international, regional and sub-regional fora and in bilateral transactions.

While this objective has long been clear to third world countries with pronouncements getting louder everyday, the implementation, unfortunately, remains very slow. Traditional obstacles still exist. Many third world countries are still tied to traditional trading partners in the North. Many of the commerciable technologies in the South originate from North-based MNCs which reduce their subsidiaries in the South to the role of cheap manufacturers and assemblers of components or products to be exported to the mother companies in the North. Since most of the countries in the South are emerging from an agricultural base, they find themselves in a similar situation of producing the same items thereby reducing the opportunities for exchanging different goods.

The strengthening of South-South business ties is a function of communications, promotion and mutually beneficial

transactions in that order. It is against this framework that we shall review the problems in strengthening South-South business ties in agricultural machineries and rural energy.

In communications, it appears that many firms in the South dealing with agricultural machineries and rural energy, particularly those wholly owned by nationals, are not linked to commercial channels of communications in their respective countries. The situation is worst in linking to clearing-house type trade journals with regional and international circulation. It is rather disturbing to note that magazines supposedly for Asia and the Pacific such as the Far Eastern Technical Review, Asian Agriculture, Asiaweek and Asian Building News Review feature primarily products/processes from the North. Sadly, even the trade and industry section of many national papers in Asia and the Pacific tend to carry more items of products/processes from the North. This is so because Northern companies or their governments' trade attaches have the material ready for press releases.

In trade exhibitions, RCTT monitors and liststrade fairs in the region related to RCTT's priority areas. We observe that except for affluent Southern countries like Japan and Korea, most of the exhibitors are companies from the North.

In using technology exchange announcements and export magazines to promote the products/processes, we also observe that except for the few affluent Southern countries such as Japan, Korea, Singapore, Brazil, Mexico and Argentina, most of the countries in the South do not have the resources to mount an aggressive and elaborate promotion programme through this channel.

The same situation holds true in the promotion of products/processes through agents of technology be they from the government or private firms.

NGO's, governments and international organizations are carrying out activities which try to fill the gap on behalf of firms in the South. These entities, for example, put out magazines on agricultural machineries and rural energy. They also serve as clearing-houses for the exchange of information - i.e. Australia's CSIRO for the Commonwealth REgional Energy Resources Information System, the Asian Institute of Technology for the Renewable Energy Information Centre, ESCAP for the Regional Network on Agricultural Machineries and for the Agricultural Information Development Bulletin, IRRI and Technonet for both agricultural machineries and rural energy and NGOs such as Approtech, Intermediate Technology Group, VITA and Tranet for both agricultural machineries and rural energy. The Asia Press Foundation's Depthnews, IDRC's Technology Features and RCTT's Asia-Tech also feature products and processes of countries from the South in the mass media. Government S&T institutions within a region usually exchange also material although I must say that their packaging of the material does not possess the aesthetic quality that would make the material appealing to potential users. India, for example, has a wealth of indigenous technologies but the product catalogue/ brochures lack the glossy touch to catch the attention of potential users.

For agricultural machineries, ESCAP's Regional Network on Agricultural Machineries established in 1978 has been very active in promoting joint cooperation among countries in Asia and the Pacific in design, standardization and local manufacture of agricultural machineries. For rural energy, various UN agencies have been involved in promoting devices, products or processes. The referral services of FAO, UNIDO, WIPO and RCTT likewise have been active in linking interested entrepreneurs to different sources of technology on agricultural machineries and rural energy.

These efforts, while laudable and providing a catalytic effect, however could not substitute for bringing firms in the South into the mainstream of commercial channels of communication. There is something about linking to a commercial channel such as the mass media which gives a product not only wider exposure but more credibility than when it is being promoted through in-house publications.

If firms in the South are not well linked to commercial channels of communication - which means that their products are not being promoted well - then the opportunities for South-South transactions are considerably minimized.

Compounding the problem of firms in the South not knowing what their colleagues are doing is the lack of standardization and testing of the products/processes. This problem is slightly alleviated in the case of agricultural machineries in Asia and Pacific due to the efforts of RNAM in assessing the products and in encouraging the establishment of standards in various countries. The case of rural energy, however, is different. Besides being new on a commercial level, many of the products/processes have yet to be tested for their efficiency, applicability and acceptability to local conditions.

On bio-gas digesters, much has been done in India and China and there are variants of models offered by both countries. Besides the question of local applicability at the technical level, there is also a cultural problem on their acceptability especially on the part of Southeast Asian and Pacific countries which are not accustomed to handling night soil. In Fiji, for instance, bio-gas digesters would work with the Indian population but would not succeed with the Fijian population.

On the briquetting of agricultural wastes, India and the Philippines have produced machineries/processes. So have Mexico and Brazil. There is still room for wider utilization and improvement of the state of the art not between countries but within the above countries themselves.

For domestic stoves, RCTT has been very active in promoting them. From what we see of stoves from the Carribbean, Latin America, Africa and Asia, there is still a need to establish the efficiency as well as promote the wider use of the stoves.

In solar energy, Tahiti leads many countries in the world, on a per capita basis, in the use of solar heaters for homes but neither this fact nor trend is known nor shared by its neighboring Asian and Pacific countries. Much work has been done on solar drying of agricultural products and lumber in India, the Philippines and Thailand but these technologies still need to be promoted. China and Pakistan are working on solar powered pumps and these devices are still being assessed by a World Bank/UNDP project. For solar-powered generators, Australia and Tahiti have been active in this area while other countries are just exploring it.

For wind energy, many of the commerciable devices come primarily from the United States and Europe. Thai sail windmills have been adopted in some Indian villages. Over-all, technologies in wind energy still need to be tested and improved.

In dendro-thermal, the Philippines leads most countries in wide-scale tree plantations to generate energy. The Philippine experience is now being watched closely by many countries.

For hydro-electric power, RCTT, UNIDO and other UN agencies have been active in providing opportunities for the exchange or experiences and in making available technical consultants. Many countries in the South, on their own, have taken a keen interest in this area.

Technically, many firms in the South know about the potential value of renewable energy for rural use. The problem, as mentioned earlier, is to establish the efficiency and applicability to local conditions of the products/processes.

The third problem is the difficulty of many firms in the South engaged in agricultural machineries and rural energy to link to the effective demand. This is a matter of knowing what the demand is and promoting the products to the potential users. There are many useful products/processes that end up in shops or bookshelves because they are not linked to the effective demand.

In this connection, it is worthwhile to recall the reaction of advocates of S&T in blaming their difficulties to a public that do not appreciate efforts in S&T. While there may be some truth to this assessment, I am inclined, on the other hand, to blame advocates of S&T for not knowing how to link to the effective demand - of knowing the market, spotting the opportunities, exploiting the linkages and promoting the products.

In view of the above problems, it is logical that the following course or action should be undertaken.

1. Firms in the South dealing with agricultural machineries and rural energy should link to the commercial channels of communication especially those with regional and international coverage.

2. There should be better standardization and assessment of the efficiency of products/processes in agricultural machineries and rural energy.

3. Firms in the South dealing with agricultural machineries and rural energy should link to the effective demand.

It is rather easy to diagnose problems and prescribe solutions in the above manner and as repeated frequently in many standard policy papers on S&T. What is difficult, however, is to establish what could really be achieved. To avoid falling into the same mistake of prescribing what should be done, I would like to suggest a more pragmatic approach for the future, namely, that government S&T and trade agencies, the chambers of commerce and manufacturers associations and the mass media and extension service firms should join hands,

in a synergistic fashion, to help firms in the South link to commercial channels of communication and promote their products.

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United Nations Industrial Development Organization

Distr.
LIMITED

ID/WG.418/2

29 February 1984
ENGLISH

Technical Congress held in conjunction
with the Third International Fair -
"Technology for the People"

Manila, Philippines, 23-25 November 1983

GAS PRODUCERS TECHNOLOGY FOR RURAL APPLICATIONS*

by

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Mention of firm names and commercial products does not imply the endorsement of the United Nations.

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V.84-82539

Producer gas technology is an old technology with a history that can be traced back more than 175 years ago.

The original gas producer is the blast furnace stove which used coke to smelt iron, and in the process produced combustible gases. These combustible gases could be fired to heat the molds into which molten iron was poured, or to preheat the air used for the combustion and gasification of coke to attain the high temperatures necessary in the processing of steel. My paper today, however, is not aimed at discussing the steel or industrial applications of producer gas, but rather to present the case of producer gas technology as used presently for rural energy requirements and its future potential.

The two main ways of using producer gas are: (1) for direct heat production as in boiler furnaces and in crop drying; and (2) as fuel for internal combustion engines (diesel and gasoline engines) to provide shaft power.

Producer gas must not be confused with biogas. This confusion can happen since biogas is more commonly known to be used also for direct heat application and shaft power production.

Raw producer gas which is produced by the incomplete combustion of carbonaceous and cellulosic solid fuels, is a dirty hot gas, compared to biogas which is a clean, cold gas produced from the bio-digestion by microbes of solid and liquid wastes. Therefore, producer gas needs to be cooled and cleaned before it can be used reliably as fuel for internal combustion engines.

Of course, there can be no need for cleaning, and cooling if producer gas is burned directly in a furnace for direct heat production since tar, the major impurity in the gas, can also be burned. But this same tar, when not removed from gas used in a gasoline or a diesel engine, can collect in the valves and piston rings of the engines and cause it to stop running.

Aside from cleaning, cooling the gas is desirable so that it becomes more dense and more gas in terms of weight per unit volume can be admitted into the cylinders of the engine. Thus, power de-rating of the engine is minimized. Power de-rating when using producer gas is inevitable because the gas contains less energy per unit volume compared to either gasoline or diesel.

In promoting the use of a new technology, or in this case the re-introduction of an old technology which has not been in used for decades, it is important that the technology should be reliable and economic. It is with this end in view that initial R & D concentrated on very simple systems that would not require costly materials and which would gasify a fuel that would not require too complicated gas cleaning equipment. One such fuel is charcoal. Good quality charcoal should contain no tar at all since this ought to have been removed during the charcoaling process. It should contain very little ash if the starting material contains very little ash. Coconut shell charcoal and that from ipil-ipil wood (leucena Leucocephala) contain very little ash and are commonly available in the Philippines.

A very simple gas producer system hooked-up to a gasoline engine is shown in this illustration (shown in slides). The gas producer reactor is a constant-diameter down-draft

reactor, the size of a 55-gallon drum. There are two major types of fixed bed reactors: the up-draft reactor and the down-draft reactor, classified by virtue of the direction of flow of air and gas through the fixed bed of solid fuels. In the down-draft flow, the air enters from the top of the reactor, and as it flows downwards, reacts with the fixed bed of fuel to form producer gas which exits from the bottom of the bed. Down-draft reactors are reported to produce less tar in the gas compared to up-draft reactors. The efficiency of gasification however is somewnat lower in the down-draft than in the up-draft.

This size of reactor could be good for a capacity of 10KW. Automotive gasoline engines could of course deliver much more than 10KW, but because of the 50% reduction in power capacity when using gas (with no gas cooling) and the need to operate at a lower RPM compatible to the speed of the electric generator (1800 RPM), then 10KW would be a reasonable output that could be expected from such a system.

Figure 1 and 2 (shown on slides) represent the simplest workable gasifier-engine system which in fact worked reliably well so long as the charcoal used was of good quality (85% fixed carbon).

But charcoal supply could be of variable quality and frequently charcoal still contains volatile matter and tar. For this reason, there is still a need, for a more reliable operation to clean and cool the gas.

Such a gasifier system, hooked up to a 7.5 KW diesel engine, is shown in Figure 3 & 4 (shown on slides), this is the same design adopted by GEMCOR for diesel-engine irrigation systems.

GEMCOR (which is the acronym for Gasifier and Equipment Manufacturing Corporation) is a government corporation that is now mass-producing gasifier equipment for the country. Presently, the equipment is designed to use charcoal mainly

as the input fuel. It was established in 1981 and as of June, 1983 has fabricated a total of 1661 units. It has adopted a 7-year program, from 1983 to 1989 which targets a production and installation of 500,000 gasifier units. To support these gasifiers with fuel, 750,000 hectares of land will be planted to fast-growing trees. The total market potential for stationary engine applications is about 30,000 units while the bulk of the potential applications is for land transport vehicles and other mobile applications at around 750,000 units.

The potential for irrigation applications is estimated at 5000 units.

For electricity generation and for small power supplies such as a 2-ton per day ice plant, the potential market is estimated at 3000 untis.

For other small engine driven processing equipment, such as portable rice threshers, but not including rice mills, the estimate of potential market is 8000 units.

For motorized bancas (native fisherman's boat) and small trawlers, the estimated market is 150,000 units.

And for land transport vehicles, jeepneys, buses, trucks, and cars, the potential market estimate is 750,000 units. Although the potential for gasifier-retrofitting of land transport vehicles is very high, acceptance of the technology by which vehicle owners may be long in coming. Operating a vehicle to run on producer gas is not a simple matter, and vehicle drivers may not presently be willing to exchange the convenience of running their jeepneys or buses on diesel or gasoline with the mess, and the inconvenience of running them on producer gas, even though the economics may be quite attractive. For jeepneys which are

kept on the road for 12 hours or more daily, GEMCOR's calculations indicate that retrofitting those with gasoline engines with charcoal gasifiers costing US $65/KW capacity of the gasoline engine, would enable the owner to recover his capital investment in less than 6 months.

Small rural rice mills represent a special case. There are 16,000 of these in the Philippines. The operation of these are seasonal, during harvest time. Payback period for a US $70/KW charcoal gasifier retro-fitted to a 25hp diesel engine in a rural rice mill is about 2 1/2 years. The question is why use charcoal: why not use rice-husks. In rice mills, rice husk is a waste and a nuisance. Using them as fuel offers two potential advantages: (1) increased savings in operating costs; (2) elimination of the waste as an environmental problem.

Research work on utilizing rice husk as gasifier fuel is on-going in at least two Philippine institutions - at the University of the Philippines College of Engineering and at the PNOC-ERDC.

CONCLUSION

In conclusion, let me summarize the case for gas producer technology and its application to supply the small energy requirements in the rural areas. An old technology has been reviewed, re-studied, and re-tested in laboratories. Innovations and modifications were made to make the technology more workable and practical for use in the rural areas of developing nations. Low cost and simplicity in operation are the primary objectives to make technology useful and acceptable. An effective collaboration among several government agencies ensued. Research and developmental work at

two government instutions, the University of the Philippines and the Energy Research Development Center of the Philippines, National Oil Co., established that simplified designs using charcoal as fuel would be the most practical approach to introduce the technology for widespread use in the rural areas. Proto-type systems for irrigation application were set up and tested by the Farm Systems Development Corporation, another government corporation. The tests lasted for two years at a demonstration farm to establish the durability and reliability of the system. Then GEMCOR, a government corporation was created in 1981 to mass produce the equipment. Acceptability of the technology was gradually established after users experienced cost benefits during the first year of operation. Monitoring the operations during succeeding years would tell us if this economic advantage will continue.

Finally, continued research on the use of the more abundant and cheap fuels such as agricultural residues should be vigorously pursued to increase the technical and economic advantages of the technology. This is a particular activity that I, as a representative of a Philippine research institution,would be most interested to undertake on a regional cooperative basis.

Distr.
LIMITED

ID/WG.418/3
29 February 1984

ENGLISH

United Nations Industrial Development Organization

Technical Congress held in conjunction
with the Third International Fair -
"Technology for the People"

Manila, Philippines, 23-25 November 1983

AGRICULTURAL MACHINERY INDUSTRY IN THE PHILIPPINES*

by

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V.84-82540

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I. INTRODUCTION

The Philippines is basically an agricultural country, although its national economic goal is to achieve a balance agro-industrial development. It has a total land area of 30 million hectares. Of the 8,217,510 hectares planted to food crops, rice accounts for 3,503,050 hectares and corn for 3,318,670 hectares. The rest are planted to root crops and vegetables. Commercial crops are planted in 3,905,890 hectares, of which 3,145,260 are planted to coconut and 424,620 hectares to sugarcane.

Farms are rather small, averaging about 2.0 hectares per landholding.

Agricultural machinery and equipment as discussed in this paper consist of the following:

1. Agricultural and horticultural machinery for soil preparation or cultivation. These include plows, seeders, planters and transplanters, fertilizer distributors, and manure soreaders; scarifiers, cultivators, weeders, hoes, and harrows; lawn and sport ground rollers; and these machine parts.
2. Harvesting and threshing machinery; straw and fooder presses; hay and grass movers; winnoving and similar machines for seed, grain or leguminous vegetablesand egg grading and other grading machines.
3. Tractors
4. Machinery used in the bread grain milling industry and other machinery for the working of cereals or dried leguminous vegetables, such as rice hullers and conetype rice mills.

2. AGRICULTURAL MECHANIZATION SITUATION

A. DEGREE OF MECHANIZATION

The degree of mechanization which can best be expressed in terms of power input to Philippine farms is only 0.2Hp per hectare, compared to Japan's 3.0Hp/ha. and U.S. of 1.0Hp/ha., Sugarcane employs the highest degree of mechanization, while coconut farming is barely mechanized.

It is estimated that there are about 5.0 million work animals which will ultimately have to be replaced by mechanical power.

B. IMPORTS

The industry imported US$ 37 million worth of agricultural machinery and equipment in 1979, US$ 25 million worth in 1980, and US$ 28 million worth in 1981. (See Table 1).

Table 1
Importation of Agricultural Machinery and Tolls
(CIF $ 000)

Machines/Tools	1979	1980	1981
Tractors	4,564	5,389	3,086
Power Tillers	1,384	376	458
Implements (Plows, Harrows, etc)	2,448	1,392	2,032
Planting/Weeding Equipment	129	161	705
Engines	17,184	5,888	8,353
Pumps	2,656	2,098	3,156
Harvesting Equipment	541	-	254
Pest-Harvest Equipment (threshers, rice mills, etc.)	6,693	7,492	8,598
Sprayers	2,269	1,865	1,238
Total	37,328	24,660	27,881

Sources: AMMDA, National Census and Statistics Office.

Due to a declining market, importations for 1982 and 1988 have further decreased.

C. EXPORTS

Very limited exports are being undertaken. This are principally in intermediate technology agricultural equipment such as power tillers, threshers, batch dryers, rice reapers, etc. which are exported to neighboring Asian countries and Africa.

D. MECHANIZATION TRENDS

1. Trends in Developed Countries

Farming practices in developed countries have undergone rapid changes due to industrialization. For example, in U.S. only 3% of the population work in agriculture and yet its production can support its population and export its surplus, whereas in many developing countries, like the Philippines, more than 50% of its population are in agriculture.

While tractor horsepower has been increasing over the past decades, tractor and fuel prices have stabilized tractor sizes to an average of 102.4Hp. Smaller tractors are also increasing to number.

The following changes are now taking place:

1. Reduced tillage inorder to reduce soil and water erosion
2. Use of more agricultural chemicals, although pollution effects are now being considered.
3. Increase in the use of lower horsepower tractors.
4. Electronic controls and sensors for engines and transmissions which is expected to match engines and speed to the load and permit more precise control over implements.
5. More refined transmissions, use of front wheel drive and 4-wheel drive to improve efficiency.
6. Use of diesel engines with improved designs on fuel economy.
7. Increased serviceability of tractors and equipment reducing daily maintenance.
8. Greater sophistication of tractors and equipment.

2. Trends in Asia

Agricultural mechanization in Asia has developed from the

manual to animal-draft power stage to intermediate technology stage. Such development has been affected by the following factors:

1. Farmers have very low purchasing power, hence, find difficultry in buying machinery.
2. Land is very fragmented, 1 to 2 hectares average, and cooperatives are not very strong except in Korea and socialist countries
3. Manufacturing is limited to intermediate technology like:
   a) implements
   b) sprayers
   c) threshers
   d) batch dryers
   e) low head pumps
   f) simple power tillers; and
   g. others
4. Complicated machinery like tractors, combines, and others are imported from developed countries like the United States, Japan and Europe.

The following changes have been experienced:

1. Transformation from manual to work animals to low technology equipments, like the use of simple power tillers and threshers, specifically those designed by the International Rice Research Institute (IRRI).
2. In many developing countries, recent demand for agricultural machinery had diminished in volume due to high energy cost and high cost of the machinery itself.
3. In many cases, the average horsepower had been reduced due to high cost of the machinery and the fragmented lands due to government land reform programs.

3. GOVERNMENT POLICIES AND PROGRAMS

A. NEDA POLICY

In line with its policies and strategies for a balanced

agro-industrial economic development, the National Economic Development Authority (NEDA), in its 5-year Development Program indicates that mechanization will be applied on a selective basis and will be adopted to local conditions and available resources.

This policy follows the "Appropriate Agricultural Machinery" Concept pursued by many developing countries with abundant labor, but scarse capital.

Determined efforts are being undertaken by government to develop the Engineering and Metalworking Industry Sector, of which agricultural machinery is a part. Several measures designed to provide encouragement of new industries in the agricultural machinery sector are being implemented or being considered.

B. BOI INCENTIVES

The government's Board of Investments (BOI) has listed Agricultural Machinery Manufacturing in its Investment Priorities Plan (IPP). Enterprises registered with the BOI are granted several incentives, such as tax credit on the basis of compliance with export or local content performance. Deductions of tariff duty and compensating tax for equipment that are purchased are applied against this performance credit.

The Board of Investments also encourages BOI-registered firms applying for permission to import agricultural machinery under tariff duty and tax incentives to buy from local manufacturers, provided the local manufacturers can meet the demand, price and specifications.

C. IMPORTATION POLICIES

Prior to October 1983, there were no import restrictions for agricultural machinery, except that Monetary Board Circular No.37 lists some locally manufactured products under close monitoring of Central Bank. All these measures are being done inorder to reduce the country's balance of trade gap. Importations are generally covered by Letters of Credit and Draft Acceptances. Upon opening Letters of Credit, marginal deposits are imposed by commercial banks.

The present foreign exchange crisis that the country is facing resulted in the temporary freezing of all imports, except those indicated in the Central Bank's priorities.

A 10-50% tariff duty advalorem and an advance sales tax of 10% based on 125% of landed cost of imported agricultural machinery and equipment, is imposed. There is no distinction between knocked down (KD) and built-up (BU) equipment, except for a few equipment.

In line with the government restructuring program, tariff duties of finished products will be increased progressively, while duties for raw materials will be reduced.

Starting January 1983, duties for all imports have increased by 3% plus another 2% starting November 1983. In addition all duties will have to be paid in advance, upon opening of Letters of Credit.

D. FINANCE AND CREDIT

The upward trend in sales of agricultural machinery and equipment from 1965 to 1976 was due largely to the availability of three (3) CB-IBRD loans.

Apart from the Rural Credit Program (CB-IBRD), the following government institutions provide credit for farm machinery and equipment: Development Bank of the Philippines, Farm Systems and Development Corporation, and Philippine National Bank. Private banks are also required by Central Bank Circular No. 473 to allocate 25% of their loanable portfolio to agriculture.

E. MA-IRRI PROGRAM

The Ministry of Agriculture (MA) and International Rice Research Institute (IRRI) Industrial Extension Program conducts periodic workshops on small agricultural equipment. Enterprises are encouraged to manufacture agricultural equipment designed by the MA and IRRI.

F. MIRDC

A Metals Industry Research and Development Center operated by the government is equipped with modern metallurgical research

and scientific equipment. Local and foreign experts assist domestic industries in their technology problems.

G. AMTEC

A National Agricultural Machinery Testing Center has recently been set up at the University of the Philippines (Los Baños) to evaluate and test agricultural machinery.

H. PICAM

Only in November 1983, the Permanent Inter-Agency Committee for Agricultural Mechanization was created as a coordinating body for agricultural mechanization. This Committee is chaired by the Minister of Agriculture and co-chaired by the Director General of the National Economic Development Authority. Various ministries and private sector organizations involved in agricultural mechanization are members of this Committee.

The Committee has the following sub-committees:

1. Research and Development
2. Manufacturing
3. Marketing and Financing
4. Education and Extension

Policies, strategies and programs and now being finalized.

4. MANUFACTURING SITUATION

A. PRODUCTS MANUFACTURED

Records of the National Census and Statistics Office show that there were 30 manufacturers and assemblers of agricultural machinery and equipment. Fifteen (15) of these were classified as large firms. The industry employed about 6,000 people. The firms produced about ₱205 million worth of agricultural machinery and equipment.

The following agricultural machinery are now being manufactured in the Philippines in commercial quantities:

1. Power tillers, single axle type
2. Tractor implements, such as plows, harrows, furrowers, etc.
3. Pumps: low head centrifugal, line shaft turbines, propeller and hand (piston) pumps
4. Hand sprayers

5. Harvesting equipment: rice reapers
6. Post harvest equipment: rice mills, threshers, driers, hammermills, feedmixers, etc.
7. Hand tools
8. Animal drawn implements

In addition, there is a manufacturer of small diesel engines with very limited production.

1. Power Tillers

In the early 70's International Rice Research Institute (IRRI) designed a low-cost single axle power tiller that would be utilized by small farmers where landholdings are small: This was principally for rice using the wet farming practices. In the Philippines alone, some 50 manufacturers embarked into the manufacturing of this product and accounted for about 90% of the power tiller market of 12,000 units in 1975.

This single product achieved the following:

1. It made possible low cost mechanization for rice farming, replacing part of the work animals used.
2. It created manufacturing activity for small and medium-sized corporations.

Unfortunately, however, a rational manufacturing program was not developed such that each manufacturer were allowed to manufacture each component required, such as the gear box, pulleys, etc. Many companies suffered from poor quality problems, compounded by depressed market demand starting in 1976, only a limited number have survived.

Meanwhile, the product has been manufactured also in other Asian countries.

Many technological innovations have been made, such as steering mechanisms, higher capacity and a "floating" power tiller for use in water-logged areas.

2. Rice Threshers

The second product that has created an impact like that of power tillers is the rice thresher. It's impact is felt both by rice farmers and manufacturers.

Where before, hand threshing was being practiced, it was no longer possible because of the Masagan 79 Rice Program which increased rice yields substantially. The introduction of the IRRI rice thresher prevented grain losses due to timely threshing.

Small and medium-sized manufacturers are currently producing the thresher in almost all parts of the country.

B. BASIC FACILITIES

Basic facilities, such as foundry, forging, metal forming, machining and welding are available. There is, however, need to upgrade quality and introduce low cost and better production techniques. Component manufacturing and heat treatment facilities are required. The government's car manufacturing program has resulted in the mass production of gasoline engines, transmissions, and body stampings for both the domestic and export market. Given the opportunity, these facilities can be utilized for agricultural machinery manufacture.

C. SUBCONTRACTING ARRANGEMENT

Subcontracting does not figure greatly in the agricultural machinery industry. The Engineering and Metalworking Sector, to which the industry belongs, envisions a future industrial estate where an engineering center can supply all the basic requirements of small manufacturers. Thus, these manufacturers will not have to put up their own facilities because they can avail themselves of the center's facilities. This scheme will be economical for the industry, and the benefits to the farmers will be in the form of affordable standardized machinery of acceptable quality.

D. STANDARDIZATION AND QUALITY CONTROL

The government has begun setting minimum standards for farm machinery and equipment such as threshers, rice mills, grain driers, and corn shellers. Manufacturers are required to comply with the minimum standards before they can sell to the public. For example, the National Food Authority conducts tests on threshers, driers, and rice mills offered for sale. A certification of compliance with set standards is issued only after a successful test run.

The Agricultural Machinery Distributors Accreditation Committee (AMDAC), a government body which accredits agricultural machinery distributors and manufacturers for them to avail of government financing, sets minimum standards for each product.

An Agricultural Machinery Testing Center has been set up at The University of the Philippines, Los Baños, to assist in this function.

E. MANUFACTURING PROBLEMS

In addition to problems of lack of basic facilities, standardization and quality control, the manufacturers face other probelsm such as:

1. Inadequacy of good quality raw materials and components
2. High production costs due to high input cost
3. Inadequate financing
4. Poor productivity
5. Inadequate volumes of production

5. MARKETING AND DISTRIBUTION

Sales figures for 1979 to 1981 were provided by the Agricultural Machinery Manufacturers and Distributors Association, Inc. (AMMDA). Table 2 shows local production and importation values during the period and their shares of the total sales of agricultural machinery and equipment

Table 2

Sales of Agricultural Machinery and Equipment
(In Thousand Pesos)

	PRODUCTION		IMPORTATION		TOTAL SALES	
	Value	%Share	Value	%Share	VAlue	%Increase (Decrease)
1979	79,481	13	512,499	87	591,980	- -
1980	59,272	18	273,438	82	322,710	(44)
1981	74,591	15	412,252	85	486,843	46

Table 3

Sales of Selected Agricultural Machinery 1978-1982
(In Number of Units)

Farm Machinery/Eqpt.	1978	1979	1980	1981	1982
Standard Four-Wheel Tractor	971	836	494	566	522
Compact Four-Wheel Tractor	295	388	161	162	131-
Power Tiller	6,301	5,379	2,993	2,901	1,157
Engine	40,526	47,388	33,312	35,731	28,247
Irrigation Pumps	4,331	4,106	2,155	1,753	1,506
Farm Processing Equipment	3,169	3,916	3,652	2,957	908

Increased production and importation were made possible by the farm mechanization program with financial aid from CB-IBRD. But from 1976 to 1978, consumption and production declined substantially because the CB-IBRD loan had been exhausted.

Manufacturers and distributors operate through mixed channels of distribution: dealers and company-owned outlets.

6. RESEARCH AND DEVELOPMENT

A. TECHNOLOGY POLICY

The development of Science and Technology in the Philippines is being coordinated by the National Science & Technology Authority (NSTA), which has recently been reorganized. Under NSTA are four (4) councils, most prominent of which is the Philippine Council for Agriculture and Resources Research and Development (PCARRD) which has been in existence for some time. Most of the agricultural machinery research and development activities are coordinated by PCARRD. The Philippine Council for Industry and Energy Research and Development (PCIERD), is a newly established council and will involve itself also in agricultural machinery.

Research and Development in the field of agricultural machinery has been strong in the country due to the efforts of the International Rice Research Institute (IRRI), which has developed intermediate technology equipment such as single axle power tillers,

threshers, reapers, pumps, driers, fertilizer applicators, etc. Government agencies, like the Bureau of Plant Industry, University of the Philippines at Los Baños, National Food Authority, etc, also do R&D work.

B. PCARRD PRIORITIES

The long term program of PCARRD is to develop research and development in various areas, according to the following priorities:

I. Research and Development of appropriate technology for production and post-production operations and systems for commodities as produced by small farmers.

In line with this, the priorities according to crop and operations are as follows:

1. Rice - land preparation, crop establishment (sowing and transplanting), crop care (irrigation, fertilizer application and crop protection), harvesting, threshing, in-farm and farm-to-market transport, drying, storage and milling
2. Cassava - planting/fertilizer application, harvesting
3. Corn - planting/fertilizer application, harvesting, shelling, drying and storage
4. Coconut - harvesting, husking, splitting, drying
5. Field Legumes - Harvesting and threshing, drying and storage
6. Sugarcane - Planting, fertilizer application
7. Fruits and VEgetables - Land preparation, harvesting, storage transporting

II. Research and Development for utilization of energy resources for agricultural production operations and utilization by rural communities, such as the following:

1. Design and development of devices, tools and equipment and appropriate systems for utilizing indigenous energy resources.
2. Testing, evaluation and modification for local manufacturing and adoption of alternative energy equipment introduced from abroad.

3. Pilot studies on the transfer and adoption of energy technology packages to the end-users.

III. Research for systems studies, such as the following:

1. Standardization of machinery components, quality control studies, introduction of basic facilities and rural workshop.
2. Policy studies for agricultural mechanization
3. Socio-economic impact of agricultural mechanization
4. Strategies for transfer of agricultural engineering technology to end-users.
5. Operations research and paper studies by multi-disciplinary teams
6. Use of manpower "displaced" by mechanization
7. Packaging of agricultural engineering technology

C. IRRI PROGRAM

The International Rice Research Institute (IRRI) Program seeks to develop machines that satisfy two major conditions. First, the designs must be compatible with the technical and economic needs of the small farmers who will use them. Second, the manufacture and servicing of these machines must be within the technical capabilities of indigenous small- and medium-scale machine shops. Drawings, design, information, and limited technical support are given free to manufacturers who want to commercially produce IRRI designs when they agree to the conditions of a Memorandum of Agreement and provide information of their manufacturing facilities and marketing plans. IRRI retains worldwide distribution and patent rights for all designs developed at IRRI and does not grant exclusive manufacturing rights and license. This policy ensures for all interested manufacturers equal access to IRRI designs and creates a competitive climate that encourages the production of quality machines, product innovation, and fair pricing.

D. RNAM

The UN-Escap Regional Network for Agricultural Machinery greatly assists local institutions in the agricultural mechanization efforts, principally research and development and manufacturing. Developments in other countries are monitored and promoted in the Philippines. It also conducts workshops, exchanges of experts, and prototypes, etc.

E. OTHER R&D ACTIVITIES

There are many other government agencies undertaking research and development such as the University of the Philippines at Los Baños, Bureau of Plant Industry, Philippine Sugar Commission, National Post Harvest Institute of Research and many state college and universities all over the country.

7. FUTURE DEVELOPMENTS

It has been noted that agricultural machinery in developed countries is becoming more and more sophisticated. In developing countries, such sophistication is not available because of so many factors not present in developed countries. Manufacturing for agricultural machinery tend to be sophisticated also in developed countries utilizing mass production techniques. There is, therefore, a need to increase capabilities for accelerating agricultural mechanization in developing countries, as agricultural mechanization increases crop yields.

The following specific areas have to be considered inorder to increase production and productivity:

1. Tillage, including proper cultivation of the soil
2. Proper planting techniques
3. Seed quality, through the use of appropriate and high yielding varieties
4. Fertilization, through application of organic or chemical fertilizers
5. Crop protection through proper control application of insecticides
6. Harvesting technology, through the use of agricultural equipment

7. Proper storage and preservation
8. Transportation, through effective and appropriate transport

A. MANUFACTURING PLANS

A workshop conducted by the government represented by the Board of Investments, Ministry of Trade & Industry, Ministry of Agriculture and other agencies, and agricultural machinery manufacturers, proposed the development of manufacturing programs for various products and components. For inclusion in the Investment Priorities Plan (IPP) as pioneer projects, the following have been suggested:

1. Mini Tractors
2. Hydraulic Cylinders
3. Gearboxes
4. Blades and Tynes
5. Control Valves
6. Hand Tools

Hand in hand with inclusion of the above products in the IPP, a manufacturing program has been proposed inorder to save or earn foreign exchange and create manufacturing activities. This program, if implemented, will require progressive increases in local content. Products proposed are as follows:

1. Power Tillers
   - 1.1 Multi-speed tillers
   - 1.2 Single axle
2. Primary Tillage Equipment
   - 2.1 Disc plows
   - 2.2 Moldboard Plows
   - 2.3 Chisel Plows
   - 2.4 Ripper/subsoilers/furrower
   - 2.5 Rotary Tillers
3. Animal Drawn Implement
4. Secondary Tillage Equipment
   - 4.1 Disc Harrows
5. Cultivating and Weeding Equipment
   - 5.1 High Clearance Cultivators

5.2 Multi Weeders
5.3 Cut Aways
5.4 Chipper Cultivators
5.5 Trash Rake
5.6 Root Rake
5.7 Disc Cultivators
5.8 Disc Ratooners
5.9 Rice and Corn Weeders
5.10 Stubble Shavers
5.11 Rotary Slashers

6. Planting Equipment
   6.1 Sugar Cane and Cassava Planter
   6.2 Rice Transplanter
7. Pest Control Equipment
   7.1 Knapsack Sprayers
8. Harvesting Equipment
   8.1 Rice Reaper
9. Post Harvest Equipment
   9.1 Multi Crop Threshers
   9.2 Dryers:
       Batch Type
       Continuous Flow
   9.3 Feedmill Plants
       Feedmixers
       Hammermills, Grinders
   9.4 Rice and Corn Mills
   9.5 Corn Shellers
10. Material Handling Equipment (agricultural tractor driven)
   10.1 Trailers
   10.2 Loaders
   10.3 Graders
   10.4 Dozers
11. Irrigation Equipment
   11.1 Sprinkler Irrigation System
   11.2 Pumps
       Volute (low head, centrifugal
       Deepwell Turbine Pumps
       Hand Pumps

8. COOPERATION IN AGRICULTURAL MACHINERY

A. ASEAN COOPERATION

For their mutual benefit, developing countries, especially within a region, most cooperate among themselves in the agricultural machinery industry inorder to accelerate its development.

As example of such type of subregional cooperation is ASEAN (Association of South East Asian Nations) which aims to achieve economic cooperation among the five Asean countries. Cooperation is being developed in all areas of economic activity - industry, trade, agriculture, transport and communications, tourism, finance, etc. In the field of agricultural machinery, the UN-ESCAP Regional Network for Agricultural Machinery has initiated information exchange among countries of Asia. It is also pushing for the creation of a National Communities for Agricultural Mechanization in each country.

In addition to the large potential domestic market for agricultural machinery, there are opportunities for an expanded market due to export and Asean Cooperation. The Asean Agricultural Machinery Federation (AAMAF) organized 4 years ago has embarked on various programs aimed at increasing intra-Asean trade, such as:

1. Preferential trading arrangements in the form of margins of preference on tariff duties now being implemented for a few products with further moves to expand preferences to a wider range of agricultural machinery.
2. Mini-Tractor Program, wherein an opportunity study has been conducted by UNIDO starting February 1983 and completed in September 1983. The report is now being evaluated by the Asean Agricultural Machinery Federation. It is envisioned that the Mini-Tractor gearbox will be a joint venture project located in an Asean country and the rest of the components to be part of an industrial complementation scheme.

B. ENTERPRISE COOPERATION

Cooperation with small and medium-sized agricultural machinery firms maybe more ideal for the developing countries rather than with large firms, as such large firms employ different management,

marketing and manufacturing concepts which are difficult to implement in developing countries.

Small firms, through their trade or industry associations or government agencies, should be encouraged to cooperate with their counterparts in developing countries as their techniques and methods are more flexible.

Even among firms in devloping countries, cooperation can be encouraged. Exchanges in information especially in research and development and manufacturing will be beneficial to parties concerned.

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